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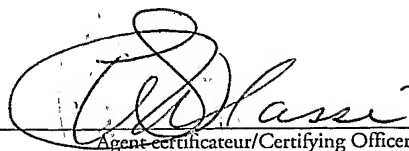
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Specification, as originally filed, with Application for Patent Serial No: **2,489,504**, on  
November 25, 2004, by **SPORT MASKA INC.**, assignee of Ray Blotteaux and Justin Roth,  
for "Bumper Shaft".

  
Agent-certificateur/Certifying Officer

March 29, 2005

Date

**Canada** 

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### **Bumper Material Selection**

The primary function of the bumper is energy dissipation. The bumper acts to absorb and distribute the shock of an external impact in a direction perpendicular to the line of action of impact.

Cast or foamed elastomeric materials are best suited to this application, there are a variety of candidate materials and vendors to choose from:

| <b>Bumper Materials</b>       | <b>Vendors</b>   |
|-------------------------------|--|
| Thermoplastic Polyurethane    | RTP, Dow, Bayer, 3M, BASF  |
| Thermoset Polyurethane        | Cytec, Innovative, DuPont, Bayer, Henkel, BJB Enterprises, GE, NuSil |
| Silicone Rubber               | Dow Corning, Silicones Inc., Bayer                                   |
| Polyisoprene (Natural Rubber) | Lavelle  |
| Polybutadiene                 | Bayer  |
| Polyisobutylene               | PRC DeSoto   |
| Latex                         | Dow, DuPont  |

All of these materials are classified as elastomers and good as dissipating energy from impact.

The range of hardness or Durometer of the bumper could be from 10 Shore A to 80 Shore D depending upon the desired balance between tactical feel and energy dissipation.

### **Injection Process and Tooling**

There are a variety of different methods for attachment of the bumper onto the carbon fiber shaft, they include but are not limited to:

| <b>Injection Process</b>   | <b>Tooling</b>  |
|--|---|
| Injection Molding - thermoplastic  | CNC tool steel or aluminum                            |
| Injection Over Molding – thermoset   | CNC tool steel or aluminum, cast elastomeric silicone |
| Pressure Molding   | CNC tool steel or aluminum                            |
| Compression Molding  | CNC tool steel or aluminum                            |
| Gravity Casting  | CNC tool steel or aluminum                            |
| Vacuum Casting   | CNC tool steel or aluminum                            |
| Secondary Bonding – this means to pre-cure the elastomeric bumper and then bond or glue the bumper in place on the shaft | Aluminum or steel alignment jigs and fixtures         |

Elastomers can be cured out from room temperature to elevated temperatures up to the limit of the glass transition temperature of the carbon fiber shaft (290 degrees F).

Over molding can be cast horizontally, vertically or with the tooling oriented at an angle. The injection can take place from either the top or the bottom of the shaft.

#### **Extension of coverage to include the blade**

A logical extension of the bumper patent is to include the blade. The external periphery (edge) of the blade could be protected with the addition of an elastomeric material. This elastomer would protect the blade not only from impacts with another shaft/blade, but also from contact with the ice.

#### **Generalized Process Specification – Bumper Shaft Injection:**

1. Install injection over molding tooling into injection press
2. Mold release the injection over molding tooling
3. Heat tooling to injection temperature
4. Wipe carbon fiber shafts with solvent to remove residual oils and contaminants.
5. Install shafts into injection over molding tooling
6. Apply compression/clamping pressure to shafts with press
7. Connect meter mix dispense equipment to injection port on injection over molding tooling
8. Discharge a metered shot of elastomer into tooling
9. Allow elastomer to cure
10. Demold over molded shafts
11. Clean tool
12. Mold release tool
13. Post cure shaft
14. Repeat

Based upon the current process development, the preferred embodiment should detail the following:

- Material – Family of Thermoset Polyurethane
- Durometer – 60-80 Shore A
- Process – Injection Over Molding
- Tooling – CNC Aluminum
- Cure Temperature – 100-180F depending upon cycle time or volume requirements